AMERICAN JOURNAL *of* PHARMACY

SINCE 1825

A Record of the Progress of Pharmacy and the Allied Sciences

Vol. 103 — JANUARY, 1931 — No. 1

CONTENTS

Price $3.00 per Annum in Advance — **Foreign Postage, 25 Cents Extra**

Single Numbers, 30 Cents. Back Numbers, 50 Cents

Entered as Second-Class Matter at the Post Office at Philadelphia, Pa., Under the Act of March 3, 1879

Acceptance for Mailing at Special Rate of Postage Provided for in Section 1103, Act of October 3, 1917. Authorized February 15, 1920

PUBLISHED MONTHLY BY THE

Philadelphia College of Pharmacy and Science

43d Street and Kingsessing Avenue, West Philadelphia, Pa.

Pharmacy
Wahr

THE AMERICAN
JOURNAL OF PHARMACY

VOL. 103 | JANUARY, 1931 | NO. 1

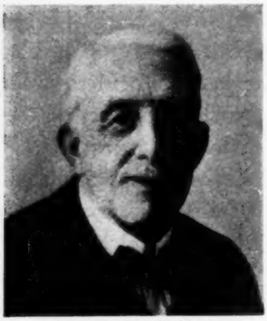
EDITORIAL

In Memoriam

HENRY LEFFMANN*
1847-1930

HENRY LEFFMANN is dead!

Unbelievably silent is the voice—strangely inactive is the mind of one—who, over the trail of many a decade, served the world in which he worked, served it with intelligence—with diligence—and with honor. His had been an unusual life, marked with an extraordinary fullness of service.



Dr. Henry Leffmann

His versatile brain carried him to diversified fields of endeavor—and left him useful and comfortable wherever it chanced to convey him.

Afield, he was quite at home with all of God's green children—flower and fern, and tuft and tree—rocks he understood—knew them with a rare intimacy—sod and soil, and many waters,—all of Nature—he surveyed with a keen delight and yet a keener understanding.

Long had he lingered—and deep his draughts at the Pierian spring of literature. In all our life we have never known one whose command of memory was quite so brilliant.

Out of the vastnesses of his mind he could summon accurately and at an instant's notice, words sweet-sung by Shakespeare—or a passage spun by Goethe.

---

*A Life-story and reports of the Memorial Meeting will be printed in our next issue. a. J. H.

Else it might have been a fragment of the song of Solomon—or a seldom quoted bit of Plato's wit—

Anywhere—everywhere in the world's literature was his mental camping place.

And then how helpful a spirit he owned. Today in the scientific eminences of America are many men and women who owe their start and their urge to Henry Leffmann's guidance. To the end he was a mentor—a directionist—who wisely started youngsters toward the right and into the light.

His own life, he arranged in such a way that earlier than is given to most men to retire from active practice, he was enabled, in comfort, to dedicate his life to a calm, considerate scheme of service.

One who serves Science for nearly three score years and ten—and serves it so intimately as Dr. Leffmann did—lives through a magnitude of mutations.

"The old order*s* chang*ed*—yielding place to new—and God fulfilled himself in many ways"—during the great man's spell of life—yet for it all there was no lagging of spirit in him—no grievances with the present nor a silly, senile love for the what-had-gone. New days were the good days for him—and to the last he held to a fine fluidity of mind and heart—and *knew* that the world was progressing.

Tolerant—friendly—familiar with art, music, literature, history, science, religion and ethics—a successful teacher—known the world over for his researches in chemistry—and for his contributions to the scientific literature—Henry Leffmann has left behind him a record seldom achieved by any one man.

In accord with his last wish—it was a friendly dust that found its way—the other morning—back to its mother dust in a sylvan dell hard by the Wissahickon—to commingle again, with its own—in a valley the doctor had always loved.

And the vale of the Wissahickon is glorified through his dust—even, as in life, his fertile impress was left upon every field wherein he labored. God bless his memory.

IVOR GRIFFITH.

WRING OUT THE OLD—RING IN THE NEW

SO UNKIND to us, in many ways, was the wisp of time man-labeled 1930, that most of us, with its passing, sang out in jubilation—

Wring out the Old—ring in the New.

For with the advent of a clean, new calendar comes, we know, a time of hope and happiness. Unpleasant memories are cast aside awhile—and only faith is fitting to our mood.

It is open season for expecting, hunting hope and chasing rainbows. And thankful we should be for that blessed privilege of expecting—blessed even though the hunter return from the hill tired and without the quarry.

Yet it must not be considered that nineteen thirty passed without its share of progress, for during its chaotic stay man continued to pursue, continued to achieve.

Herewith are recorded the notable advances* made in various fields of science during the year just gone.

BIOLOGY Quarantine restrictions on Florida fruit and vegetable shipments, designed to prevent the spreading of the Mediterranean fruit fly, were wholly removed on November 15.

The plant breeder who originates a new variety of plant propagated by asexual or vegetative means was given, by act of Congress, the right to a patent of his living product.

The world's largest fish hatchery was completed near Lonoke, Arkansas, for the propagation of the warm-water nest-building fishes, such as bass and bream.

A new instrument, a modification of the interferometer, was devised by Prof. K. W. Meissner, of Frankfort, Germany, making it possible for the first time to see a plant grow.

A swarm of locusts appeared across northern Africa, from Egypt almost to Gibraltar, and extended into the Near East and Balkans.

That the fungus of black stem rust is capable of producing hybrids and thus multiplying the strains which attack wheat, was discovered by Dr. J. H. Craigie, of the Dominion Experimental Farms at Winnipeg.

*Compiled from statistics appearing in *Science Service* and in the *Jour. A. Ph. A.*

Two sets of human identical triplets were reported by Alfred E. Clarke and Daniel G. Revell, biologists of the University of Alberta, Canada.

Animals can manufacture the growth-promoting vitamin A in their bodies from carotin, it was found by Dr. Thomas Moore, of Cambridge, England.

A herd of thirty musk-oxen was transplanted from Greenland to Alaska by the United States Department of Agriculture in an effort to re-establish them in the latter country.

Dr. J. Markowitz and Dr. H. E. Essex, of the Mayo Foundation, were successful in keeping alive the internal organs of an animal for twelve hours after the animal had died.

Man lowered himself farther into the ocean depths than ever before when William Beebe and Otis Barton descended 1426 feet in a steel sphere off the coast of Bermuda.

CHEMISTRY The existence of rotating molecules in solid compounds was reported by Prof. Linus Pauling, of the California Institute of Technology, and Dr. Sterling B. Hendricks, of the Fixed Nitrogen Laboratory, United States Department of Agriculture; this discovery has an important bearing on the heat capacities of solids.

The magnetic susceptibility of samarium sulphate octohydrate was announced by Simon Freed, of the University of California, arousing great interest among chemists because the discovery indicates the possibility of electronic isomers in the solid state.

The chemical puzzle of the structure of the crystal of the silicates was solved by William L. Bragg, Victoria University of Manchester, England, and Prof. Linus Pauling, of the California Institute of Technology.

A new gas for use in electric refrigerators, non-poisonous and non-inflammable, which is a compound of carbon, chlorine and fluorine, was the invention of Thomas Midgley, Jr.

Carotin, the stuff that makes some foods yellow, is important for nutrition as well as the green chlorophyl, because vitamin A is associated with this color in vegetables, butter, and egg yolk, it was discovered by S. M. Hauge and J. F. Trost, of the Purdue University Agricultural Experiment Station.

Bacteria obtained from brewer's malt may now be pressed into the service of the chemist to eat away the cell walls of plant tissue and

liberate the vegetable oil, according to a method developed by John Woods Beckman, Oakland industrial chemist.

A device for removing carbon monoxide from the exhaust gases of an automobile by means of a catalyst was demonstrated by the inventor, Dr. J. C. W. Frazer, of Johns Hopkins University.

The richest source of helium yet discovered, a natural gas in southeastern Colorado containing 7 per cent. of helium, was reported by F. F. Hintze, of the University of Utah.

Crystals of rubber were obtained for the first time in the chemical laboratories of the United States Bureau of Standards.

The United States Pharmacopœial Convention, which meets once in ten years to decide on the contents of the Pharmacopœia or standard for drugs and chemicals, met in Washington in May.

MEDICINE

A hormone from the cortex of the suprarenal glands was isolated by Drs. W. W. Swingle and J. J. Pfiffner, of Princeton University, and used by Drs. Leonard G. Rowntree and C. H. Greene, of Mayo Clinic, to treat hopeless victims of Addison's disease, in the same way that insulin affects the coma of diabetes. Dr. F. A. Hartman and Dr. K. A. Brownell, of the University of Buffalo, also obtained an extract of the same gland.

The filterable virus germ which causes multiple sclerosis, or "creeping paralysis," was discovered with the aid of a special ultramicroscope at a magnification of 1800 diameters by Sir James Purves-Stewart and Kathleen Chevassut, of the Westminster Hospital, London.

An artificial lung, or respirator, was invented by Drs. Philip Drinker and L. A. Shaw, of the Harvard School of Public Health, to keep alive patients whose breathing muscles are paralyzed in infantile paralysis or who are victims of gas poisoning.

A new method for studying the microscopic growth of living tissue in a warm-blooded animal was developed at the University of Pennsylvania School of Medicine.

An enzyme which has both protective and curative action on Type III pneumonia in mice, and possibly also in man, was extracted from a bacillus found in the soil of New Jersey cranberry bogs.

Vitamins in sufficient amounts will prevent infection of animals, and possibly man, with leprosy, it was reported by Dr. J. Shiga, dean of the Imperial Medical Faculty, Seoul, Korea.

Fever produced by short radio waves was found helpful in the treatment of paresis by Prof. W. T. Richards, of Princeton.

The National Institute of Health was created by act of Congress, replacing the Hygienic Laboratory of the United States Public Health Service.

A new species of the meningococcus organism, cause of meningitis, was found by investigators of the United States Public Health Service.

Cancer studies were reported by numerous investigators. Drs. Walter B. Coffey and John B. Humber, of San Francisco, announced a method of treating cancer by injection of a glandular extract. Drs. Shigemitsu Itami and Ellice McDonald, of the University of Pennsylvania, reported they were unable to cure cancer in mice by this method. Dr. Frederick S. Hammett, of Philadelphia, found that the application of partly oxidized sulphur compounds caused tumors in mice to disappear.

Postgraduate demonstrations of cancer, in which radiologists, pathologists and other specialists tested and increased their diagnostic ability, were held under the auspices of the Surgical Pathological Laboratory of the Johns Hopkins University.

Experiments proving that the common cold is caused by a filterable virus were reported by two groups of investigators: Dr. Gerald S. Shibley, Katherine C. Mills and Dr. A. R. Dochez, of the Columbia University College of Physicians and Surgeons and the Presbyterian Hospital of New York, and Drs. Perrin H. Long and James A. Doull, of the Johns Hopkins Medical School.

An extensive outbreak of psittacosis, popularly known as parrot fever, occurred in the United States and many other countries. In this country 169 cases with 33 deaths were reported. Investigators of the United States National Institute of Health made an extensive study but did not find the *Bacillus psittacosis,* which a French scientist, E. Nocard, had reported as the causative germ in 1892. They concluded that the disease was caused by a filterable virus. They did find an organism which might be the cause of the disease, but it was not *B. psittacosis* or any other member of that germ family.

A phenol compound, tri-ortho cresyl phosphate, was found by the United States Public Health Service to be the adulterant which caused thousands of cases of partial paralysis from drinking bootleg Jamaica ginger, known as "ginger jake."

A new chemical method of standardizing ergot, widely used in childbirth, was devised by Dr. M. I. Smith, of the National Institute of Health, formerly the United States Hygienic Laboratory.

A large increase in the number of cases of infantile paralysis, almost reaching epidemic proportions, occurred during the fall of 1930.

An occupational disease, causing an involuntary to and fro shifting of the eyes, was found among train dispatchers by the Industrial Health Conservancy Laboratories of Cincinnati.

The time required for blood to clot, vitally important in surgical operations, is shortened by feeding the patient vitamin D, it was discovered.

Study of the chemical changes taking place in the brain was made possible for the first time through a technical procedure developed by Dr. Abraham Myerson, of Boston, whereby blood is taken from the artery leading to the brain and from the vein which drains the brain and the chemical contents of the two samples compared.

New hope for recovery of child victims of serious burns was given by a treatment, making use of a tannic acid solution, devised by Dr. Edward C. Davidson of Detroit.

Radio waves, shorter than those commonly used for sending messages, are able to weaken materially the poison elaborated by the diphtheria bacillus, it was discovered by Drs. Waclaw T. Szymanowski and Robert Alan Hicks, of the Western Pennsylvania Hospital Institute of Pathology.

A new method for measuring the heart's output of blood by determining the amount of acetylene gas taken up by the lungs in a certain time was devised by Dr. Arthur Grollman, of the Johns Hopkins University.

An international birthday party, with the celebrations round the world united by radio, was given in honor of the eightieth birthday on April 8 of the "dean of American medicine," Dr. William Henry Welch.

The three hundredth anniversary of the first use of cinchona bark, from which quinine is obtained for the treatment of malaria, was celebrated.

To study the problems of the American child, scientists from all over the country, at call of President Hoover, met in a White House Conference on Child Health and Protection, at Washington, November 19 to 22.

The flarimeter, an instrument which will disclose whether a person has heart disease in advance of serious developments by measuring shortness of breath, was demonstrated by Dr. P. V. Wells, of Newark, N. J.

A new barbituric acid derivative, the sodium salt of isoamylethylmalonylurea, was discovered and found to be valuable to the surgeon in producing a state just short of deep sleep.

Calcium gluconate, formerly only a laboratory curiosity, was discovered to be an effective medicine.

PHARMACY The eleventh decennial meeting of the United States Pharmacopœial Convention, composed of physicians and pharmacists, representing colleges of medicine and pharmacy, medical and pharmaceutical associations, and scientists representing other related organizations, gathered in Washington on May 13 and 14 to frame the policies which will guide the work of revising the Pharmacopœia to bring it up to date within the next few years. The officers of the Committee of Revision, U. S. P. XI, are the following: E. Fullerton Cook, Philadelphia, chairman; A. G. DuMez, Baltimore, first vice-chairman; Dr. W. A. Edmunds, Ann Arbor, Mich., second vice-chairman; Charles H. LaWall, Philadelphia, secretary. The Committee of Revision is composed of fifty-one members.

A color exhibit at the Pharmacopœial Convention, May, 1930. showed that 267 color names are used about 2400 times in U. S. P. The exhibit gave an historical account and methods for analyzing and naming colors.

Dr. Lyman Spalding, Father of the U. S. Pharmacopœia, was one of the nominees for the Hall of Fame. Though unsuccessful in the election, his name will again be presented for the honor in 1935.

Julius W. Sturmer was elected president of the American Association of Colleges of Pharmacy, C. B. Jordan was elected chairman of the House of Delegates, American Pharmaceutical Association.

The issuance of the "Pharmaceutical Recipe Book" by the American Pharmaceutical Association is an outstanding event of the year which places in the hands of the American pharmacist a book of reference and of non-official formulas. A purpose is to establish a greater uniformity in the dispensing of the latter.

The Ebert Prize for 1930 was awarded by the American Pharmaceutical Association to Marvin R. Thompson, for some time assistant pharmacologist of the Food and Drug Administration, United States

Department of Agriculture; he is now Emerson Professor at the University of Maryland. The award was made for his contributions on the pharmacology of ergot.

Dr. Edward Kremers, of the University of Wisconsin, was awarded the Remington Honor Medal for 1930 for his distinguished service to pharmaceutical education and research and his promotion of interest in the history of pharmacy. The award was established in memory of Prof. Joseph P. Remington by the New York branch of the American Pharmaceutical Association. Other recipients, in former years, are: James H. Beal, John Uri Lloyd, H. V. Arny, H. H. Rusby, George M. Beringer, Henry M. Whelpley, H. A. B. Dunning, Charles H. LaWall, Wilbur L. Scoville.

Pharmacy Week of 1930 was a great success. President Hoover and Secretary Hyde, of the Department of Agriculture, and Secretary Julius Klein, of the Department of Commerce, sent congratulatory messages. National Chairman Robert J. Ruth states that the profession of pharmacy is solidly behind the National Pharmacy Week movement, which is primarily in the interest of public health. Each year the observation of Pharmacy Week is increasingly successful and indicates that professional pharmacy is assuming a greater importance in the minds of the pharmacist and the public.

An unfortunate error in dispensing at an army hospital dispensary resulted in the death of two children. The occurrence pointed to the need of qualified pharmacists for dispensing, whether in civil or government activities, and an editorial in the August *Journal of the American Pharmaceutical Association* calls attention to the importance.

The Attorney General of Illinois has ruled that no person in Illinois, unless he or she is a registered pharmacist, may be a member of a partnership engaged in any manner in the operation of a drug store.

Dr. John C. Krantz, Jr., pharmacist, has been appointed chief of the Bureau of Chemistry by the Maryland State Board of Health, succeeding the late Dr. Wyatt W. Randall.

The introduction of bills in the Senate and House of Representatives to provide for the creation of a pharmaceutical corps in the United States Army, and the hearing before the House Committee on Military Affairs on these measures, marked an important step in the steady advance toward the recognition of pharmacy in the various branches of the Government service.

According to Peter Valaer, more than 16,000 persons were poisoned in the United States by drinking a ginger beverage containing

tri-ortho cresyl phosphate and di-ethylene glycol. Quite a number of deaths resulted, but in most of the poisonings paralysis followed.

The election of officers of the American Pharmaceutical Association for 1930-1931 resulted as follows: President, Walter D. Adams, Forney, Tex.; first vice-president, J. G. Beard, Chapel Hill, N. C.; second vice-president, J. W. Dargavel, Minneapolis; members of the council, H. A. B. Dunning, Baltimore; S. L. Hilton, Washington; Ambrose Hunsberger. Philadelphia.

The three hundredth anniversary of the first recorded use of cinchona was celebrated at the Missouri Botanical Gardens, October 31 and November 1. This anniversary coincides with the one hundred and tenth anniversary of the separation of quinine by Caventou and Pelletier, the noted French pharmacists, and the fiftieth anniversary of the discovery of *Plasmodium malariæ* by the French pathologist, Alfonse Laveran.

The first floor of the Cleveland City Hospital has been equipped for the pharmacy of the hospital. Three registered pharmacists are employed, all of whom are graduates of pharmacy. The new Lake Side Hospital of Cleveland, which is part of the University Hospital group, will move into its new quarters about January 1st. Three registered pharmacists are employed.

PHYSICS The theory that the sun is lighted like a giant electric bulb by electricity under pressure of ten million volts flowing from inside the sun and heating its atmosphere to incandescence, was advanced by Dr. Ross Gunn, United States Naval Research Laboratory.

A new physical concept, the paradoxical one that two separate particles of matter can be completely identical, was enunciated by Prof. Gilbert N. Lewis, of the University of California.

That space is not empty but filled with electrons of minus or negative energy, was suggested by Dr. P. A. M. Dirac of Cambridge University, England.

A new theory of the universe, assuming that it is non-static and consisting of matter dissipating through radiation, was propounded by Dr. Richard C. Tolman, of the California Institute of Technology.

The possibility that the whole universe is fading away so that in some timeless future no matter will remain, only radiation, was indicated by calculations made by Dr. Louis S. Kassel, of California Institute of Technology.

The theory that cosmic rays are not rays at all but high velocity particles was advanced by two German physicists, Dr. Walter Bothe, of Berlin, and Dr. Werner Kolhoerster, of Potsdam, as a result of experiments they have conducted with a specially built adaptation of the electron counter, but researches of Dr. R. A. Millikan on the intensity of cosmic rays near the north magnetic pole provided evidence against the theory.

The theory that cosmic rays consist of high-velocity particles, like tiny bullets, was supported by experiments conducted by Dr. L. F. Curtis, of the United States Bureau of Standards, in which he used two electron counters.

A clock which will set itself in response to radio time signals was developed by H. C. Roters and H. L. Paulding, of the Stevens Institute of Technology.

A new type of clock controlled electrically by a vibrating crystal, thus dispensing with a pendulum, has been developed under the direction of Dr. W. A. Marrison, of the Bell Telephone Laboratories.

A molded compound, including silicon carbide or carborundum, which has the quality of preventing the flow of electricity at low voltages while allowing it to pass at high potentials, was developed at the laboratories of the General Electric Company.

The method by which the diameters of stars have been measured through the interference of light waves was applied to the extremely accurate measurement of terrestrial distances in an instrument developed by Stuart H. Chamberlain, of Michigan State College.

A device for measuring the intensity of ultraviolet rays by means of an ultraviolet-sensitive photoelectric cell connected with a condenser, which as it discharges operates a counter, was developed in the research laboratories of the Westinghouse Lamp Company.

A film phonograph capable of playing for two hours from a 400-foot reel of motion picture sound film was perfected by Dr. C. H. Hewlett, engineer of the General Electric Company.

A method for stopping a locomotive with the reflected light from its own headlights caught on mirrors on the signal post and focussed by them on a series of light-sensitive cells was demonstrated in Germany.

Alternating electric current is more dangerous at low voltages than at high, it was discovered through experiments on rats at Johns Hopkins University. With the ordinary house potential of 110 volts, 100 milliamperes will cause death.

Electric current direct from sunlight was made possible through the invention by Dr. B. Lange, of the Kaiser Wilhelm Institute for Silicate Investigation, of a new type of cell containing copper oxide between two layers of metallic copper.

Dr. Ernest O. Lawrence, of the University of California, with his associate, Dr. N. E. Edlefsen, devised a method for increasing the speed and energy of the protons or hearts of hydrogen atoms so that it may be possible when the method is further perfected to use them as atomic projectiles for smashing the hearts of other atoms, transmuting them into other substances or releasing enormous quantities of atomic energy.

A method of taking photomicrographs by long wave ultraviolet light through an ordinary glass lens was discovered by Dr. A. P. H. Trivelli, of the Eastman Kodak Company, and Leon V. Foster, of the Bausch & Lomb Optical Company.

The final value for the most accurate measurement ever made of the constant of gravitation was announced after seven years' work by Dr. Paul Heyl, physicist of the United States Bureau of Standards, to be the fraction 6.670 over 100,000,000.

Artificial gamma rays, which may take the place of radium in the treatment of cancer, are produced by a giant vacuum tube operating at 700,000 volts, at the California Institute of Technology.

An electric photoflash lamp, a German invention, for taking flashlight photographs without noise or smoke was introduced in the United States, the light being made by aluminum foil ignited electrically in a bulb full of oxygen.

PSYCHOLOGY AND PSYCHIATRY

Slow motion pictures enabled Dr. Knight Dunlap and G. H. Mowrer, of Johns Hopkins University, to analyze the motion of a chicken's head in walking and to find that the head jerks forward only, serving to give the fowl clearer vision.

The First International Mental Hygiene Congress met at Washington from May 5 to 10, with 2000 specialists in attendance.

Diseases suffered during childhood set a definite mark on personality, Dr. H. W. Newell, of Richmond, Va., found by a study of identical twins.

A psychiatric service to assist judges in determining sentences of convicted offenders was recommended by the Committee on Psychiatric Jurisprudence of the American Bar Association.

Mental disease shortens life to a startling degree, it was found by Dr. Neil Dayton and Dr. Carl Deering, of Boston, who discovered that the individual's expectation of life is reduced two-thirds by psychoses.

Statistical methods applied to psychiatry by Prof. Thomas V. Moore, of the Catholic University of America, in an effort to chart exactly the symptoms of various mental diseases, determined the existence of forty-one different symptoms.

Genealogical studies at the German Research Institute for Psychiatry, Munich, reported by Prof. E. Rudin, showed that among families having one parent afflicted with manic-depressive insanity, at least a third of the children will be similarly afflicted, and another third will be otherwise mentally abnormal.

A service whereby the job-seeker may take tests and obtain an authentic credential to present to prospective employers was inaugurated by the Psychological Corporation of New York City.

In a study of motormen involved in traffic accidents, Dr. O. M. Hall, of the Personnel Research Federation, found that practically half had health defects, chiefly abnormal blood pressure and hernia, and 39 per cent. had personality defects.

RECOGNITIONS AND AWARDS

For his researches on light, particularly the discovery that monochromatic light when scattered by shining on certain transparent substances is partly changed to other colors, Sir Chandrasekhara Venkata Raman, professor of physics at the University of Calcutta, was awarded the Nobel Prize in physics.

The 1930 Nobel Prize in medicine was awarded to Dr. Karl Landsteiner, of the Rockefeller Institute of Medical Research for the discovery that human blood is of four different types and that blood of one type does not always mix with blood of another type.

The Nobel Prize in chemistry was awarded to Prof. Hans Fischer, of Munich, for his achievement in the laboratory production of hemin, one of the components of hemoglobin, the red coloring matter of blood.

The Daniel Guggenheim gold medal for notable achievement in aeronautics was awarded to Dr. Ludwig Prandtl, professor at the University of Gottingen, Germany, for "pioneer and creative work in the theory of aerodynamics."

The distinguished flying cross of the Navy was given to all members of the Alaskan Aerial Survey Expedition, which mapped nearly 13,000 square miles of wild country during 1926.

The Collier trophy for the outstanding contribution to aviation was given to the National Advisory Committee for Aeronautics for its cowling for radial air-cooled engines.

Dr. George H. Whipple, of the University of Rochester, and Dr. George R. Minot, of Harvard University Medical School, shared the first $10,000 Popular Science annual award given in recognition of their discovery of a successful treatment of pernicious anemia by the liver diet.

The Harmon trophy for the outstanding achievement in aeronautics was awarded to Carl B. Eielson, who piloted Sir George Hubert Wilkins across the Arctic.

The Perkin medal was awarded to the late Dr. Herbert H. Dow, president of the Dow Chemical Company, for his developments of improvements in the production of chlorine, bromine, magnesium and other chemicals.

The James Douglas medal of the American Institute of Mining and Metallurgical Engineers was awarded this year to John V. N. Dorr, president of the Dorr Company, for "his invention of apparatus and achievement in developing and improving hydrometallurgical practice."

The National Academy of Sciences' public welfare medal was given posthumously to Stephen T. Mather, organizer of the United States National Park Service.

The National Academy of Sciences' Daniel Giraud Elliot gold medal was awarded to Dr. Henry Fairfield Osborn, of the American Museum of Natural History, in recognition of his scientific monograph describing the ancient titanothere, a prehistoric creature somewhat resembling the rhinoceros.

A gold medal and accompanying annuity of from $100 to $500 to be given government workers for scientific achievements was proposed in a bill before Congress.

The William H. Nichols medal for 1930 was presented by the New York section of the American Chemical Society to Samuel E. Sheppard, of the Eastman Kodak Company, for his "outstanding achievement in the chemistry of photography."

The Willard Gibbs medal was awarded to Dr. Irving Langmuir for "fundamental work on atomic hydrogen and on surface relations

and also on electrical discharge phenomena; also for his contributions of great importance to nearly all branches of physical chemistry, including high vacuum technique, electronics, thermochemistry and catalysis, and lastly for his presentation of a theory of atomic structure."

The John Fitz medal was awarded Rear Admiral Watson Taylor, U. S. N., retired, for his engineering achievements, the most notable of which is his utilization of the bow wave in ship propulsion.

The Edison medal of the American Institute of Electrical Engineers was awarded to Prof. Charles F. Scott, of Yale, for his pioneering work in electric transmission.

The Franklin medal, awarded by the Franklin Institute, was given this year to Sir William Bragg, director of the Royal Institution of Great Britain.

In recognition of his demonstration that protons act like waves, Prof. Arthur J. Dempster, of the University of Chicago, was awarded the $1000 prize given annually by the American Association for the Advancement of Science.

The Hoover Medal was awarded for the first time, the first recipient being President Herbert Hoover.

The American Pharmaceutical Association gave its Ebert prize for 1930 to Marvin R. Thompson, of the University of Maryland, for his work on the pharmacology of ergot.

Dr. R. R. Spencer, of the United States Public Health Service, was awarded the American Medical Association's gold medal for original work in preparation of a vaccine for Rocky Mountain spotted fever.

—And so we repeat that, with all its man-made chaos, nineteen thirty had also its generous share of God-guided, man-made progress.

IVOR GRIFFITH.

ORIGINAL ARTICLES

DOPE: THE STORY OF THE USE AND ABUSE OF OPIUM

By Horatio C. Wood, Jr., M. D.

ALL OF YOU are familiar with the beautiful lines of the Canadian poet McCrae, beginning: "In Flanders fields the poppies grow," but perhaps you may not all know that a more famous war poet, the Grecian Homer, sang of the poppy nearly three thousand years ago. But the Asiatic poppy of which Homer spoke was probably not the same species as that which spangled the fields of Belgium with its brilliant scarlet flowers.

Horatio C. Wood, Jr., M. D.

The poppy to which Homer refers* is less showy as a flower but is of far greater importance as the source of the drug known to us as Opium. The Greek word "opion," from which we derive this drug name, signifies a juice and was probably applied to various plant juices used for medicines. But the value of poppy-juice so far exceeded all others that in course of time "the juice" came to mean only one thing, it was not necessary to specify what juice was meant. It is interesting to note that the name of this drug in every language is a corruption of the Greek word "opion." We call it *opium,* the Chinese call it *Ah-pien,* the Turk call it *Ahfyam.*

THE WHITE POPPY

The botanist names the opium poppy "Papaver somniferum" which literally translated means "sleep-bearing poppy." It is an annual herb usually about three or four feet high, with coarsely toothed leaves—not dissected as in the scarlet poppy—and bearing large flowers which vary in color

*There are two species of poppy growing in Asia Minor, one with scarlet flowers, the other with white; only the latter is medicinally active. While it is uncertain which species Homer meant by *Mekon* the context seems to indicate it was the white flowered poppy.

from almost white to purple. Probably a native of Western Asia, it is now extensively cultivated in Persia, Turkey, India and China. It has been grown in other parts of the world, even as far north as England, but its cultivation is not commercially successful in Europe or America because of the high cost of labor.

The seeds are usually planted in November and if the weather be propitious the young plants will survive the winter. In exceptionally cold seasons, however, some of them may be killed and a spring planting required. But the winter poppy is preferred because it yields a larger harvest. In April or May the plants begin to bloom and about June drop their petals. The fruit, which is of the type known to the botanist as a capsule, varies in shape from globular to oval and is about the size of a small hen's egg. As it ripens, it turns a golden yellow color.

It is noteworthy that of the dozen species of poppy there is only one which is known to yield a narcotic juice. Travelers in China sometimes refer to the opium fields ablaze with scarlet, but while there is a red poppy which grows in China it produces no opium. As far as we know no narcotic principle is found in any part of the plant except the fruit. Both the leaves and the seeds have been used for food. The most favorable period for collecting the juice is just as the fruit is beginning to ripen.

COLLECTING THE OPIUM

The method of gathering this crop is today essentially the same as that described by Dioscorides nearly 2000 years ago. When the evening dew has fallen, the collectors pass through the fields armed with a peculiar knife. This knife has a narrow blade, often three of them set parallel attached to one handle. With this implement the operator makes a number of little gashes in the rind of the fruit. Much skill is required in making the cuts because if they are too deep there is likely to be a loss of the valuable juice. Twenty-four hours later the workers pass around the field, bearing a small tray or one of the large leaves from the poppy in their hand, and scrape off the juice which has oozed out through the night on to this receptacle. The soft plastic mass collected is partially dried and afterwards kneaded into balls ranging from one-half to two pounds in weight.

The collection of opium does not appear to seriously injure the fruit which is usually left on the plant and successfully ripens its

seeds. After these are thoroughly ripe a second harvest, this time for the seeds, is made. The latter are used either as a foodstuff or as a source of oil.

The opium which comes into our markets is in the form of rounded lumps, usually more or less flattened, of a dark brown color and with an odor somewhat similar to that of unroasted coffee. It contains a large number of alkaloids, the most important of which is morphine.

OLDER THAN THE SAGE OF COS

Just when mankind first learned of the medicinal virtues of the poppy juice is unknown. The great Hippocrates, usually called the "Father of Medicine" (460-372 B. C.) was familiar with the plant and recommended its leaves as a food, but he does not appear to have been acquainted with its anodyne qualities. Theophrastus, the first botanist and a pupil of the great Aristotle, whose span of life almost overlapped that of Hippocrates (372-285 B. C.), according to Dioscorides, used as a medicine some sort of extract from the poppy which he called "mekonion" (the Greek word for poppy is "Mekon"). Erasistratos, a contemporary of Theophrastus, also refers to the medicinal properties of this poppy, but the earliest positive record of an understanding of its action was from Heraclides of Tarentum (240 B. C.) who used the drug to produce sleep. Pedanius Dioscorides, who was physician to the army of the Emperor Nero, wrote in the first century a magnificent treatise on Materia Medica, which still remains one of the world's great medical classics, in which he accurately describes the method of collecting the drug, and shows a very clear perception of its medicinal virtues.

While from the beginning of the Christian era some knowledge of the effects of opium was widespread among the medical profession, it did not become a popular medicine for many centuries. The famous Galen, whose fiats remained the guiding principles of medical practice for 1500 years, said it was a desperate medicine only to be used in extremities. According to Hill (History of Materia Medica, 1751) the credit of breaking down the prejudice against it is to be attributed to the Swiss physician Felix Platter (1536-1614). It was but shortly after his time that the drug achieved the reputation it still holds of being the most treasured weapon that the physician has at his command in the warfare against suffering.

SYDENHAM'S LAUDANUM

An English physician Thomas Sydenham introduced the alcoholic preparation which we call "tincture" in 1669 and this was for more than a century and a half the favorite form of administering the drug. In 1815 a Hanoverian apothecary named Serturner found that the narcotic properties of opium resided in an organic alkali to which he gave the name of "morpheum," in honor of the dream god of the Romans, and which we now know as the alkaloid *morphine.* This principle has, to a considerable extent, replaced the older and bulkier forms of the drug. This discovery of Serturner's is of importance not merely because it afforded a more convenient method of exhibiting a valuable remedy, but much more because it marks a turning point in the history of medicine. It was the birth of an idea in pharmaceutical chemistry which dominated that science throughout the remainder of the nineteenth century.

MEDICINAL PROPERTIES

In small doses opium produces, in those not accustomed to its effects, a pleasant feeling of lassitude and well-being. The distresses of life, whether mental or physical, lose their poignancy. With somewhat larger quantities even agonizing pains may be completely abolished. With these larger doses there comes a feeling of drowsiness and if the subject is left alone he will soon fall to sleep. He can be awakened from this sleep, however, by various means, as loud noises or shaking. Even in the severe cases of poison it is nearly always possible to arouse a patient temporarily, but when left alone he will immediately drop off to sleep again.

There is a quite widespread idea that the pleasant drowsiness produced by moderate doses of opium are accompanied with interesting dreams, an erroneous belief apparently founded largely on the writings of that famous English opium eater Thomas De Quincey. The probabilities are that De Quincey's statements about his opium dreams were pure fiction invented during the intervals when he was not under the influence of the drug. Certain it is that if they ever occurred they are a very unusual phenomenon.

Life is full of suffering and a large proportion of the physician's activities are directed to the alleviation of pain. Medical scientists have been searching for years for drugs which would abolish pain. With the single exception of the group of remedies of which ether and chloroform are examples, they have never found anything which

can compare in certainty or power with the products of the poppy, and the effects of the anaesthetics last but a relatively short time and their value is largely limited to surgical conditions.

OPIUM THE QUEEN

Opium with its various derivatives, such as morphine, stands unrivalled in our Materia Medica as the queen of pain-assuagers. It has other valuable medicinal properties besides this, but had it no other virtue, this one power alone would make it rank as one of the most blessed of drugs.

Imagine a battlefield and a mangled, bleeding, soldier lying out in the cold rain. The over-worked ambulance corps is striving tirelessly to remove the wounded, but one might perhaps lie there for hours enduring most frightful agony until death comes to his relief. Then the field surgeon, however, comes along, slips out his hypodermic needle with its blessed morphine and in five minutes the torture is gone. Perhaps the wounded man may be gotten back to the hospital an hour or two later, in time to save his life, or perhaps he lies on the field until he dies of exhaustion, but even in the latter case the gift from the opium has, at least, made his dying moments free from agony. Similar conditions may arise in peace time as the result of disease. Even if opium cannot cure the patient, it makes life endurable. Whether he eventually recovers or dies, through its effects he has been spared days and perhaps weeks of torment. Those of you who have never borne or watched the horrible suffering which may come to the sons of men cannot appreciate the ineffable boon which this drug has been to mankind, but the medical profession whose lives are spent in the presence of these horrors, regard it as their greatest treasure.

OPIUM THE CURSE

And now having painted the picture of the gentle, beneficent, Queen Opium, let us look at the portrait of the horrible Circe—alias Dope—robbing men of their humanity and changing them into worse than swine by her fiendish magic.

Human nature is so constructed that mankind is continually taking God's most precious gifts and perverting them to uses by which they become a curse to humanity. Thus, depraved mankind has made of this beneficent assuager of pain the most menacing habit poison of modern times. Of all the drugs in which man indulges for the satisfaction of unnatural craving, none so threatens the wel-

fare of the world as does the juice of the poppy. For a century opium has been called the curse of China, and justly so. People have vaguely believed that it was a Chinese habit occasionally indulged in by Europeans; but it is the curse of America as well as the curse of China. It is not a Chinese habit in the sense of having originated in that great country. It seems probable that the first use of opium as a habit was among the Moslem people, whose religion forbade the stupefaction of alcohol.

A RECENT HABIT

There is no authentic record of any opium addiction further back than the middle of the seventeenth century, and it does not appear to have been introduced into China until the early part of the eighteenth, although the drug had long been used in that country for medicinal purposes. So rapidly did it gain popularity and so obviously pernicious were the effects of its use, that as early as 1728 an edict against its sale or use was issued by the Emperor.

There is the same sort of morbid interest aroused by the study of this human depravity as is incited by the pathological freaks of the side show, or the instruments of horror in the torture chamber. The victims of the opium habit satisfy their induced cravings by an interesting variety of methods.

THE PIPE

The most romantic and one of the oldest methods, and which is still the favorite among the Asiatics, is opium smoking. Cast your mind back some three hundred years when nobody in Europe or Asia or Africa knew of the solace of tobacco. How extraordinary must have seemed the effects of tobacco to its early devotees. From Sir Walter Raleigh's time the habit spread with furious rapidity all over Europe and into Asia, but soon the smoking of plain tobacco lost its "kick" (to use an untranslatable word from modern slanguage). It was probably a Persian, or perhaps a Turk,* who had the thought of mixing some opium with his tobacco and it is probably in that form that the habit first came to China but her ingenious and artistic sons invented a special technique and a special apparatus for smoking opium; the present-day opium smoker would not think of diluting his narcotic with tobacco. The opium pipe bears little resemblance to the tobacco pipe.

*Pomet in his "Histoire de Materia Medica" (1694) says that the Turks "when they go into battle take it in excess which puts them out of their good sense," so that they rush headlong into battle without concern for danger.

Opium smoking is not widely practiced at present in this country chiefly because of the fact that the elaborate technique requires special places, which constitute what are popularly known as "opium dens." These are almost impossible to conceal because of the peculiar and pervading odor emitted by burning opium. The activity of our anti-narcotic police, either of the States or Federal Government, keeps this form of vice from ever becoming very prevalent in this country.

Europeans, ever a bibulous people, seemed formerly to prefer taking their dope by mouth. In the last century drinking laudanum was the most common method of indulging their weakness, especially in England. The invention of the hypodermic syringe, about the middle of the last century, opened an opportunity for another, and perhaps the most pernicious, form of the habit. Opium itself is not suited for hypodermic injection but its alkaloid morphine is very potent and eminently available for this purpose.

Probably the most widely employed method among the American habitues is the hypodermic injection of morphine. The method by which the dope fiend injects morphine is essentially the same as that which the physician uses, except that the dope fiend is not careful about the cleanliness of his apparatus and the spots of the injections sooner or later are almost sure to become seats of infection. I have seen the victims of this habit a mass of scars, looking almost like the consequences of a severe case of smallpox, from the hundreds of abscesses which have followed their dirty injections.

About the beginning of the present century chemists busied themselves by modifying slightly the chemical structure of morphine in the hope of finding a new drug which should have the valuable medicinal properties of morphine without some of its objectionable features. Among the products of these activities was an artificial alkaloid which was introduced into medicine under the name of heroine—But it has turned out to be the villain of the dope tragedy! Of all forms of addiction it is probably the most baleful. So destructive and seductive is it, that despite its valuable medicinal qualities the importation or manufacture of heroine in the United States is forbidden by special Federal enactment. Nevertheless it is the most popular of the opium products among the underworld of the Atlantic States. As all of it has to be smuggled into the country, comparatively little of the drug finds its way to the centers of the country far removed from ports of entry.

A curious feature of heroine addiction is that its devotees usually take it by "sniffing;" that is in much the same way that the dandy of a century ago took his tobacco in the form of snuff. There appears to be some strange pleasure in the tickling the inside of the nose.

EFFECTS OF HABIT

Ambition is the child of discontent. Man strives for something new because he is not satisfied with what he has. Feeling the discomforts of poverty he toils with vigor for money; desiring to be the giver, instead of the receiver, of orders he strives for power; pained by the suffering of humanity he devotes his life to the search for better methods of curing disease. Destroy dissatisfaction and you kill progress.

The primary effect of dope is precisely that destruction. It soothes pain and assuages grief. Under its influence the devotee is no longer unhappy in his poverty nor concerned for the misery of others. Why should he strive or struggle? All he asks is to be allowed to enjoy in quietness the pleasant languor of indifference. But after a time the effects of the drug begin to wear off and he gradually awakens to the unpleasant realities of life; to his previous causes for dejection is added the prick of conscience at the cowardly mode of escape he has employed. Tormented by his troubles, lacking the courage to take up arms against them, he flies again to the former nepenthe. So the round begins again. Each time that he awakens from its pernicious serenity the stronger is the yearning to return. From repeated use the drug begins to lose its power. No longer is the tranquillity a pleasure, only the awakening is a torture; oblivion becomes his highest hope. But merely to quiet the devils of consciousness requires ever increasing doses and eventually there is added to the moral deterioration the physical injuries of poisonous doses.

And now enters on the scene a new problem. The increasing doses become a financial drain, the blighting effects, both mental and physical, are diminishing his earning power. He *must* have the drug. How to get it is his only anxiety. No sense of morality, no fear of punishment can restrain him. Usually he lacks the virility for crimes of violence, but no act is too repulsive or mean for the confirmed dope addict. Well is he called a dope "fiend." He will lie, he will steal, he will sell his daughter, he will cheat his best friend. He becomes the most despicable of the criminals who fill our jails. Bootleggers and sneak thieves are recruited from the slaves of opium.

I do not hold, as do some authorities, that these symptoms show that opium causes a breakdown of the moral character. If you were starving and a rich hard-hearted neighbor refused to alleviate your need, to help yourself to some of his excess would not necessarily betoken an unusual moral weakness. The pangs of hunger are trivial to the torment of opium deprivation in the addict. His conduct arises not so much from a failure to appreciate the wrong of his action as from the violence of his yearning which dominates all other considerations. My experience of drug addicts is that when their craving for dope is stilled their moral character is not very different from the mass of mankind.

One who has never witnessed the suffering induced by opium hunger in the addict can form no idea of the frenzy of torture; at times it even surpasses the limits of human vitality and the sufferer may die of exhaustion.

Of all the drug habits which have enslaved humanity—tobacco, alcohol, hasheesh—none forges stronger chains nor exerts a more baneful influence over its victims than opium. Rich and poor, genius and dolt, young and old have been its prey. I have already referred to that erratic genius Thomas De Quincey who, despite his native talent which occasionally burst into dazzling eloquence, has left behind him only one enduring piece of literature his "Confessions of an English Opium Eater." This barrenness I think may justly be attributed to the opium habit he acquired while yet a student at the University of Oxford. Samuel Taylor Coleridge, the author of that beautiful, if somewhat gruesome poem, "The Rime of the Ancient Mariner," whose work as a critic and philosopher as well as a poet places him in the very forefront of English men of letters, became addicted to the drug in early middle life. A biographer in writing of this period of his life has said: "Little by little the habit grew and the black drop at length enslaved him. It injured his constitution, killed his imagination, enfeebled his will and destroyed his sense of truth and honor." In the latter years of his life Coleridge wrote: "After my death I earnestly entreat that a full and unqualified narrative of my wretchedness and of its guilty cause may be made public, that at least some little good may be effected by my direful example."

We may be tempted to minimize the destructiveness of opium addiction when we read of men whose native endowment was great enough to save something worth while from the wreck of their lives, but we do not hear of the thousands of men of brilliant promise

whose lives were ruined by their slavery and whose deaths were unrecorded and leave no mark in history. The public knows only of those exceptional geniuses whose flame could shine even through the murk of their opium-clouded intellects; it hears but little of the ruined morals that fill our jails with opium criminals and of the blasted lives that become economic parasites of society.

I suppose that many of you, if not most of you, have known of a drunkard who, after almost completely wrecking his life on the rock of alcoholism, broke his slavery and became a useful citizen. I have known many dope addicts, but I never knew one of them to permanently give up the opium habit. I once heard the late George Long who served fallen humanity for so many years as the head of the Inasmuch Mission, a reformed drunkard and jailbird, say in a public speech that he had been also at one time an opium habitué. I should not, therefore, like to be understood as saying that no one was ever cured of the habit, but I have not met personally anyone who was.

If this story that I have been telling you tonight is true, and dope is in reality the menace to national prosperity that I have painted it, why have not the governments of the world done something about it, you may ask. To which I reply that they have.

CHINA FIRST AGAIN

Apparently the first people to realize how serious is the peril hidden in the insidious poppy juice was the Chinese. In 1728 the Celestial Emperor issued the first edict against this habit. It was not until 150 years later that the Caucasian nations began to realize the possible disaster foreseen by the Mongolians. Europeans, with that inexplicable smugness of supposed racial superiority with which the white race is wont to regard the yellow, dismissed the subject of opium habit with the thought that it was a peculiar weakness of the Chinese and that the more virile Caucasian would never become entangled in its meshes. Our complacency blinded us to what was going on.

In 1906 Bishop Brent, whose activities as Episcopal Bishop in the Philippine Islands had brought him to realize the destruction wrought among his Chinese parishioners, together with Dr. Hamilton Wright, appealed to President Roosevelt to take some action in the matter. They succeeded in arousing his interest and when Roosevelt was aroused something generally happened. An investigation of the conditions in this country caused a wave of horror, if not terror, whose movement was felt even in Europe, and in 1909 was held

the first world conference on the control of the opium habit at The Hague. A second Hague conference held in 1912 led to the passage of the Harrison Narcotic Act by the United States Congress in 1914. Today publicists and physicians all over this country and in Europe are alive to the menace of the situation.

THE LAW STEPS IN

Since the passage of the Harrison Narcotic Act and the subsequent enactment by many state legislatures of similar laws, the Government has waged a vigorous, if not entirely successful, campaign against the great kingdom of dope. With a law so stringent as the Harrison Act and with an organization so powerful as the United States Government, the ordinary man of the street cannot see why more is not accomplished, but he underestimates the powers of the Principalities of darkness. He is prone to cry "Graft" and to accuse the Government agents of slackness if not actual dishonesty.

I have known several of the Federal narcotic agents and all that I have met were intelligent, energetic officials with a real interest in their work. I believe that the great majority of them are as honest as the majority of this audience; that their failure to enforce the law is due to the magnitude of the task that confronts them. You have, through reading the newspapers, some hazy concept of the difficulties of prohibition enforcement. If you remember that an ounce of morphine (that one can easily carry in one's pocket) is worth $20, you get some idea of how vastly more difficult it is to prevent the smuggling of morphine than to stop the smuggling of whiskey; and it you will realize that there is absolutely no price that the dope fiend will refuse to pay, you begin to understand how great are the temptations for the unscrupulous to engage in this traffic. When whiskey goes to $10 a quart most of its devotees stop drinking, but when morphine goes to a correspondingly exorbitant price, its devotees turn highwaymen or burglars to get the money to pay the price.

As long as opium is available it seems almost hopeless to stop this smuggling. Most of the students of the problem have become convinced that the only hope of ultimate success lies in destroying the stream at its source; that is, we must come to the regulation of the production of the crude drug and that can be successful only by international agreement. If, for example, China, as she once did, stopped the cultivation of opium it would result only in the larger production in India or Persia. To be successful such a move must

be joined in by all the world unitedly. So strongly did the authorities at Washington feel the truth of this, that although Congress has not allowed this country to become a member of the League of Nations, they did send an American delegation to the conference called by the Opium Committee of the League in 1924. Incidentally that Conference was shipwrecked on the same rock of national selfishness that has smashed so often the hopes of world disarmament. We are today in precisely the same situation toward the solution of this problem that we were ten years ago, with the single exception that there is a wider appreciation of its importance.

I would not have you think me a pessimist. I confess that I see little prospect of any international agreement on the opium question in the near future, but I do not feel that we should therefore abandon the struggle as hopeless. I am convinced that much has been accomplished in this country, that there is a decided decrease in the number of drug addicts in the last sixteen years. I have faith enough in the American people to believe that if the world will not help us we are still strong enough of ourselves to break the chains of drug slavery, be it opium or alcohol.

KING COTTON*

By George Wesley Perkins, M. Sc.

Assistant Professor in General Chemistry, Philadelphia College of Pharmacy and Science

"KING COTTON" is a king indeed, a product which in its various manufactured forms gives employment to more human beings than any other product in industry. To plant and produce the cotton crop of this country alone, more than 2,500,000 farmers and laborers are required; for the cotton crops of other countries, more than 1,500,000 workers are needed. In 1925, in the United States, 468,352 persons in 1,638 establishments were employed in the spinning of the cotton fiber and weaving of cotton cloth. In Great Britain, in 1921, 588,000 persons were employed in a similar capacity. In 1914, the acreage devoted to cotton growing in the United States, was 37,406,000, which has not been equaled since. One can readily see that a very large part of our population are directly and indirectly dependent upon the continued prosperity and stability of the cotton industry.

George Wesley Perkins, M. Sc.

KING COTTON

About ten years prior to the Civil War, David Christy published a book called "Cotton is King or Slavery in the Light of Political Economy." Shortly, after in 1852, James H. Hammond used the phrase "King Cotton" in the United States Senate. As far as we know the usage of this phrase dates from this time.

Cotton was known in India before the conquest by Alexander, and Herodotus (445 B. C.) refers to this Indian cotton in some of his writings. Marco Polo, in some of his writings says that India produces "the finest and most beautiful cottons that are to be found in any part of the world" (about 1298 A. D.).

The Greeks, Romans, Moors and Mohammedans are accredited with having spread the use and manufacture of cotton cloth to other

*One of a Series of Popular Science Lectures presented at the Philadelphia College of Pharmacy and Science, 1930 Season.

parts of the civilized world. In Egypt, however, flax was the common material from which clothing (linen) was made, and all mummy cloths so far examined have been found to be linen cloth; this does not signify, however, that the use of cotton was unknown to the Egyptians, for there is some confusion in the early writers respecting the terms used for "flax" and "cotton." In China and Japan silk was the customary dress and the introduction and use of cotton cloth was very slow. The cotton cloth in use in India at this early date, although woven in a crude and primitive manner was of good quality and degree of fineness.

BY ANY OTHER NAME Some of the names given to the cotton fiber in different countries are as follows:

India	Pucu
Spain	Algodon
Yucatan and Ancient Mexico	Ychcaxihitvitl
Tahiti	Vavai
France	Coton
Italy	Cotone
Germany	Baumwolle
Persia	Pembeh or Poombeh
Arabia	Gatn, Kotan, or Kutn
Cochin China	Cay Haung
China	Hoa mein
Japan	Watta ik, or Watta noki
Siam	Tonfaa
Hindoostan	Nurma
Mysore and Bombay	Deo Kurpas and Deo Kapas
Mongolia	Kohung

The cotton plant is indigenous to Peru, and cotton cloth has been used in Peru from an early date. Ancient Peruvian mummies have been found wrapped in cotton cloth. The North American Indian was acquainted with some varieties of cotton, only those tribes, however, in the southern part of the country. The Indians used the fibers of a great many different plants to make strings, nets and in some cases clothing.

Cotton cloth was one of the first American products mentioned by the narrators of the Columbus expeditions. One of the earliest written documents relating to Columbus states that on the Island of

Guadalupe, during the second expedition was found "a great quantity of cotton, both spun and already prepared for spinning." Ferdinand Colon, the son of Columbus, relates in one account that on the first voyage, a considerable quantity of cotton was seen in one house and further that "the cotton grows naturally about the fields, like roses, and open of themselves when they are ripe, but not all at the same time; for upon one and the same plant they have seen a little, young bud, another open, and a third coming ripe, . . . none of them (the Indians) make use of it to clothe themselves, but only to make nets for their beds which they call hamacas."

Another early writer, Rochefort describes a second kind of cotton which crept along the ground like a vine. These two kinds of cotton are still common in the West Indies. There is slight evidence that the Indians ever extensively cultivated the cotton crop. In 1540, the Spanish Explorers in the Southwest, found cotton in use among the Indians of Arizona and New Mexico, and it seems quite probable that it was a cultivated crop, for we know that they had a high degree of civilization.

The actual origin of the different varieties of cotton in use today, is doubtful. There were some native American varieties and some Old World sorts; and both are perennials if planted south of the "Frost" line. There is a strong possibility that some of the present strains are the results of crossing Asiatic and native American plants. In the eighteenth century, cotton growing was beginning to be an important industry in the South, but very little was exported. The English manufacturers favored the Asiatic (East Indies) cotton because it was white and wove white. Some of the early southern planters obtained the seed of the Asiatic variety and tried them with success. In 1746, some of this introduced cotton was sent from Virginia to Manchester, and there it sold for eighteen pence a pound. Not, however, until after the Revolution, did the export trade in cotton begin.

In 1669, the Lord Proprietors of the Colonies, of the Carolinas, sent an expedition, under the leadership of Joseph West, to settle on Ashley River. West was instructed to stop at the Barbadoes and procure a supply of: "Cotton Seed, Indigo Seed, Ginger wots;—some Canes (sugar canes) Olive setts,—half a dozen young sows, and a Boare." Under West's leadership, the first agricultural experimental farm was established for the purpose of testing the adaptability of these crops to the soil of Carolina. After two seasons' trial,

the Lord Proprietors were informed that sugar cane and cotton would not stand the winters in Carolina. The trouble was due to the fact that the annual and not the perennial varieties were used. Then it was found that the perennial variety was satisfactory, and an advertisement of the Carolina Company, published in 1682, in England, stated "Cotton of the Cyprus and Smyrna sort will grow well, and good; plenty of the Seed is sent thither."

An interesting activity of the Connecticut colony in the year 1640, was the laying of an assessment "to provide a vessel to trade for cotton wool," not that they wanted cotton clothing especially, but they had discovered that a coat well padded with cotton was an efficient protection against Indian arrows and later every family was ordered to have one such coat in its possession.

The French in Louisiana, introduced and grew and improved a strain of cotton that was a species of the white Siam, and was much better and brighter than the cotton of the English colonies.

FAMILY HISTORY

The cotton plant is closely related to a flower that is probably known to most of us, namely, the Althea or Mallow, both members of the natural order, Malvaceæ. The genus, Gossypium, of this order, contains the different species of cotton plants.

The plant is a shrub from two to six feet in height, and requires a fairly rich soil and a warm climate. The season for sowing the seed is from the middle of March to the middle of April, in this country. The plant will flower in June and the bolls will ripen and burst open in September.

There are two principal types of cotton, the long stapled and the short stapled. The former is called Sea Island and Egyptian Cotton and the latter is called Upland Cotton. Most of the cotton is of the latter variety.

The cotton is picked by hand at a cost of about fifty cents per 100 pounds. A day's picking will be about 300 pounds, and a good picker averages around $1.50 per day. An acre of ground will, on an average, give close to 200 pounds of cotton.

The cotton is collected and gathered and weighed and then carried to the gin. The cotton gin was invented by a Yankee school teacher, who found himself out of work in the South, namely Eli Whitney. Whitney, was a Yale graduate who had earned his way

through college by his mechanical skill and was very ingenious in the application of machinery.

One day, Whitney, on a visit to the plantation of Mrs. Nathaniel Green, met some Southern cotton growers who told him of their need for a device to separate the seed from the cotton. In a few weeks he developed such a machine. This completely revolutionized the output of cotton. At the time of Whitney's death, in 1825, fifty times as much cotton was being produced.

The cotton gin is essentially a lot of circular saws, mounted on the same shaft and the saw blades pass through narrow slits or fingers. The seed will not pass through the slots and the cotton fiber is literally cut and pulled from the seed. A rotating brush sweeps the cotton from the saw. Upland cotton when ginned produces seed with a certain amount of linters attached. In order to get the linters off, specially constructed gins with closer and finer saw teeth are used.

The Sea Island cotton fiber separates readily from the seed. The raw cotton from the gin is compressed into bales in a hydraulic press to an average weight of 500 pounds. The raw cotton after ginning and baling is loaded in flat cars, boats, etc., and shipped to the big cotton warehouses to be sampled and graded. There are thirteen grades or designations for the quality, staple and condition of the cotton that are officially used. Grade and value do not run parallel except for cottons that have the same qualities of staple. Impurities in cotton are generally, leaves, dirt, cut seeds and strings and unripe fibers.

MAKING THE GRADE

In the commercial grading of cotton, a classification is adopted with reference to the quality of the fiber. The usual grades are as follows:

Fair	Good middling
Strict middling fair	Strict middling
Middling fair	Middling
Strict good middling	Strict low middling
Strict good ordinary	Middling tinged
Good ordinary	Strict low middling tinged
Strict good middling tinged	Low middling tinged
Good middling tinged	Middling stained.

The "fair," "middling fair," "middling," etc., are known as full grades, while those intermediate are half grades. The "middling"

grade is the one universally employed as a basis for all cotton trading and the price of cotton is fixed on this standard.

The principal factors in the grading of cotton are length of staple, uniformity strength, color, cleanliness, and flexibility. The first may be determined by the gradual reduction of a tuft of cotton by the hand until individual fibers are drawn from the tuft, so that their length may be ascertained. The uniformity of staple is also important, for if the staple is uneven the cotton is of less value than if it were somewhat shorter but more even. The color of the fiber must also be considered, because this is of importance in maintaining an even shade of yarn. The cleanliness of the fiber affects the amount of waste made in the mill and hence is an item of great importance. The flexibility of the cotton is best ascertained by the feel; flexibility does not necessarily imply lack of strength, but rather includes it, for a weak fiber is more liable to be brittle than flexible. On the other hand, a fiber may also be strong and harsh and yet not flexible, and hence less suitable for fine spinning. The strongest cottons are used for warp yarns as such yarn is required to withstand considerable strain during weaving, a feature which is not required to such an extent by filling yarns. The latter, however, require a soft and flexible fiber.

The cotton fiber has a very characteristic appearance. It looks more or less frayed and twisted and is readily distinguished under the microscope from any other fiber, due to this peculiar twisting shape. It consists of an outer cover called the "Cuticle"; the inner part is pure cellulose and contains a canal in the middle which represents the nucleus of the cell.

The natural, spiral-like twist present in the cotton fiber causes the latter to be especially adaptable to purposes of spinning. The spinning qualities of the cotton fiber, however, depend not only on the nature and amount of twist which causes the individual fibers to lock themselves firmly together, but also on the length and fineness of staple.

After the cotton is ginned it is sent to the mill to be made into yarn. After the bale is opened it is run through more machines, where it is beaten up and torn apart and then put through a carding machine, which contains thousands of tiny wires which comb the cotton and lay it in parallel rows. After the cotton is carded it is run through another machine, where it is then combed and divided into small strands. The fibers, being in parallel rows, go from one machine to another until the fibers are reduced in size by constant drawing and

twisting until it gets harder and stronger and further reduced in size, and finally we have the cotton thread.

By numbers or counts in cotton the following is meant: No. 1 would mean that the thread would contain 840 yards to the pound, a thread such as used by the housewife on a sewing machine like No. 60 would be 60 times 840 yards in length in 1 pound of weight of the thread.

It seems that we can grow nothing of economic and important use to man unless there is some pest that interferes with the growth of various plants. In the South we have the young cotton boll infested by the "boll-weevil," a member of the beetle family. It seems that in 1892 this little beetle or weevil, about as large as the common house fly, crossed the Mexican border and began its invasion of the southern cotton States.

The boll weevil spread from year to year until by 1921 the whole of the Cotton Belt in the South was infested by the insect. In the same way we note the spread of the Japanese beetle, as each year it is necessary to increase the area under quarantine. An enormous amount of research has been done by the Department of Agriculture at Washington to determine the best methods for combating the weevil, but the little pest seems to be holding his own. It is interesting to note that in one part of the South the weevil was a blessing in disguise. In the town of Enterprise, Coffee County, Alabama, there is a very large and beautiful monument erected to the boll weevil, for this reason: before the weevil had invaded as far as that county in 1915 the average cotton crop was 35,000 bales, but in three years the crop was reduced to 3000 bales. Their sole means of livelihood was cotton and absolute ruin was imminent. Diversification of crops was tried and peanuts, corn, hay and sweet potatoes were planted, the income from these crops was more than that received from the former cotton crop and the farmers were saved from extermination through this diversification of crops and not by depending solely upon cotton. Intensive methods must be used to combat the weevil and in order to protect the large acreage of cotton, airplanes are being used to dust the insecticidal powders such as calcium arsenate, saving considerable time and labor. In the same way some of the large fruit growers in California dust their large orchards, in other words they cover the orchards or fields with a "smoke screen" composed of the necessary insecticide.

Great Britain leads the world in the production of cotton cloth and yarns. There are several reasons for this: first, our country was still a large farm (Colonial period) when England had large manufacturing centers; second, in order to successfully spin cotton yarn the atmosphere must be more or less humid, especially in spinning fine counts (fine threads). The climate of certain parts of England is exactly suited for this purpose. Great Britain owns about 40 per cent. of the world's spindles and manufactures about half of world's production of cotton cloth.

In 1844, John Mercer found that when cotton was passed into a 30 per cent. solution of caustic potash it shrinks and gains 50 per cent. in strength, and at the same time assumed a high degree of luster. This process is known as mercerizing. Essentially, it relates to the action of certain chemicals on cellulose, whereby the latter is changed to a product known as cellulose hydrate, although, technically, the term has come to mean the process concerned with the imparting of a silk-like luster to the fiber. As generally understood, it consists briefly in impregnating cotton with a rather concentrated cold solution of caustic soda and subsequently washing out the caustic liquor with water, the material being either held in a state of tension during the time it is treated with the alkali in order to prevent contraction, or stretched back to its original length after treatment with the alkali, but previous to washing, in either case, the material must be in a state of tension during the process of washing.

MERCERIZING Cotton is largely mercerized both in the form of yarn and woven fabric. Yarn mercerizing may be carried out in the skein or in the warp; the latter being the favorite process in use in America, while in Europe nearly all yarn mercerizing is done in the skein. Machines for skein mercerizing are so arranged that the hanks of yarn are stretched between revolving rollers and successively subjected to the action of caustic soda, a washing with warm water, and finally a washing with cold water. The operation of most forms of machines is entirely automatic. In another form of apparatus the hanks are placed over a perforated horizontal drum, the latter is then revolved at a high rate of speed while the solution of caustic soda is applied from the inside and washing with water is done in the same manner. The tension in this machine is produced by the centrifugal force arising from the high speed of rotation.

A silky luster resembling that produced by mercerization can be given to cotton cloth by means of what is known as a calender finish. This is accomplished by passing the cloth between rollers under heavy pressure, one of the rollers being engraved with obliquely set lines ruled from 125 to 600 to the inch. The effect is to produce a great number of parallel, flat surfaces on the cloth, which causes it to acquire a high luster. By conducting the operation with hot rollers quite a permanent finish can be produced which closely approximates mercerized cotton. Cloth so finished, however, loses its luster in a large degree on washing.

The cottonseed as they come from the gin still have short fibers attached to them. These fibers are known as lint or linters. The seed are passed through a machine similar to the regular cotton gin, but made with finer teeth and practically all of the linters are removed. About 10 per cent. of the weight of seed consist of these linters before removal. These linters are used in the manufacture of cotton batting and of nitrocellulose.

Nitrocellulose is also known as guncotton, soluble cotton, pyroxylin and chemically as cellulose nitrate. In 1855 a Swiss, Andemars, patented a process for spinning a thread from an ether-alcohol solution of nitrocellulose. Several years previous several workers had found that the nitrocellulose was soluble in a mixture of three parts of ether and one of alcohol but not in ether or alcohol alone. This solution of the nitrocellulose in ether-alcohol was known as collodion and was used in the "wet-process" photography. An amateur picture taker of that day had to carry an enormous amount of material with him in order to take pictures by this process, for it was necessary to prepare his plate, expose it, and then develop it right on the scene. Today one purchases a film made perhaps months before and it can be developed within a reasonable time after the exposure has been made.

The successful realization of the idea of spinning a solution of cellulose into a fiber was accomplished in 1884 by a Frenchman by name of Comte de Chardonnet. This process is one of those used today by several large companies, hence the name Chardonnet silk. Nitrocellulose alone is very inflammable and clothing made from it would upon ignition cremate the wearer. The degree of inflammability depends upon the extent of the "nitration" of the cellulose. Artificial silk made by this process is "denitrated" after spinning by pass-

ing the thread through certain chemical solutions (ammonium sulphide).

Later some different workers found that cellulose would dissolve directly in a solution of copper oxide in ammonia water, and this solution of cellulose when spun into an acid bath would process a thread of cellulose with a silk-like luster. So today we also have the cuprammonium process for making rayon by this process.

In 1892 two English chemists, Cross and Bevan, began an extensive research on the composition of cellulose and discovered that it was capable of forming a compound called cellulose xanthate, made by treating cellulose with caustic soda and carbon disulphide. This solution was called viscose because of its viscosity, and when spun into an acid bath produced a thread of cellulose that was silk-like in character. Today 80 per cent. of the artificial silk or rayon made in this country is by this process and it is known as viscose silk. An immense plant for the manufacture of viscose silk is situated down at Marcus Hook and has been in operation for a number of years. About 85 per cent. of the stock of the Viscose Company of America is owned by Courtaulds, Limited, of England, and since 1914 has made a net profit each year of from 12 to 30 per cent. of the capitalization, a very profitable business indeed.

Another cellulose product discovered by Cross and Bevan is known as cellulose acetate and this product has just recently been used on a commercial scale. Celanese silk is made from cellulose acetate. When cellulose acetate is made into motion picture film it is called non-inflammable or slow-burning film because it burns slowly compared with the nitrocellulose film stock.

These four processes as briefly mentioned above are the means by which all of the cellulose products of a rayon type are prepared, that is to say, some form of cellulose from a natural source, like cotton linters (there are numerous other sources of cellulose, but we are discussing in this lecture only such products as have their principal origin in the cotton plant) is totally changed in form by solution and from that prepared solution of cellulose compound the cellulose is regenerated and spun into a thread or filament, or made into sheets, or made into tubes.

The regenerated cellulose in the form of threads is called rayon or by the older name artificial silk; in the form of filaments or thick threads it is known as artificial horsehair; in the form of films it is known as cellophane, and this also includes photographic film which

is called "film"; it may also be in the form of tubes of various sizes, known as straws for the smaller sizes up to tubing used for the casings around "hot dogs" and cigar wrappers, etc. There are other cellulose products rightly so called such as paper, etc., but they are not made from the cellulose of cotton.

After the formation of the rayon thread it is made up into skeins or wound on bobbins. Various kinds of fabrics can then be woven in the usual way. It is interesting to note that although there is considerable waste in the manufacture of rayon all of the waste saved by special processes is spun into yarn. The yarn spun from this waste is, strange to say, stronger than a straight rayon spun yarn.

An ordinary pair of men's silk socks will weigh about 14/12 of an ounce (1 dozen pairs = 14 ounces). The size of the yarn in the socks averages about 33 times 840 yards to the pound, so one pair of socks unraveled would stretch about two miles. For all rayons except acetate rayon (cellulose acetate) the ordinary cotton dyes can be used. In a square inch of dyed sock there are about 20,000,000,000,000,000,000 molecules of dye, but if each molecule were the size of an orange the whole area of the United States could be covered about 3000 feet deep.

Viscose silk is also made from wood pulp, but all nitrocellulose is made from cotton linters. The Hercules Powder Company, of Wilmington, Del., is the largest single producer of nitrocellulose in the world. The cotton linters are treated with a mixture of nitric and sulphuric acids and then whirled in machines to get rid of the excess acid just like clothes are dried in the laundry. The nitrated cotton linters which are now nitrocellulose is boiled for days in very large wooden vats to get rid of the last traces of acid, for traces of acid might cause decomposition of the product if it is stored for a period of time.

The estimated world production of rayon, or artificial silk, is 397,125,000 pounds, of which the United States produced 131,325,000 pounds in 1930. The world's total production of artificial fibers today amounts to only about 3 per cent. of the natural fibers.

From this nitrocellulose we can make rayon, as noted above, or pyralin (celluloid), artificial leather or lacquers. Some years ago a man by name of John Wesley Hyatt, of Albany, N. Y., a typesetter by trade, heard of a prize of $10,000 that was offered for a substitute to replace ivory tusks in the manufacture of billiard balls. He had heard that two men, Parks and Spiel, of England, had prepared a

plastic mass with camphor and nitrocellulose dissolved in a solvent and with castor oil; they labored under the impression that castor oil was necessary to make the product plastic. What is known as flexible collodion today contains some castor oil, but the product is nothing like celluloid. Hyatt was a great believer in heat and pressure because of his experience with printing presses. Hence, in 1869, he found that when he took a mixture of nitrocellulose and camphor, mixed them together and then put them in a hot press, that a plastic mass was obtained which could be molded into all kinds of articles, and so we have the beginning of the celluloid industry.

Cellulose that is only moderately nitrated is generally called pyroxylin; if medium nitrated it is called nitrocellulose, and highly nitrated cotton (cellulose) is called guncotton. The further the nitration is carried on the cellulose the more inflammable it becomes. Cotton we know will only burn very slowly or smoulder, while pyroxylin burns quickly and guncotton burns in a flash, so that a piece of guncotton can be held on the palm of the hand and ignited and it will burn so quickly that one will not be burned. This property makes it valuable as an explosive. If the product was used alone in a big gun it would burn so fast that the gun would explode before the shell could be propelled out of the muzzle. By dissolving the guncotton in a solvent like acetone and then molding it into the form of rods, cubes, or grains, the speed of burning can be slowed down to almost any desired rate, and since it does not leave any soot, it is called smokeless powder, and millions of pounds of it are used every year. If guncotton is mixed with nitroglycerine and a little vaseline we have an explosive known as "cordite," and it was invented by a Swedish chemist, Alfred Nobel, the founder of the Nobel prize. Nobel is also credited with the invention of dynamite.

The development of the production of wide sheets of various thicknesses of cellulose is comparatively new. These products are generally collectively known as cellophane and can be produced in very thin sheets and dyed at the same time in various colors. This product is used extensively today for wrapping all kinds of products. They are made mostly from "viscose" cellulose. Thick sheets of the celluloid type and of the cellophane also can be embossed with various finishes (like moire) or incorporated with different pigments or with an extract from fish scales (pearl finish pyralin products). Thin solutions of cellulose when mixed with the material of fish scales and coated on the inside of thin walled spheres are called artificial pearls.

When solutions of nitrocellulose in different solvents are mixed with pigments and certain gums or resins and the resultant product coated on wood or metal, a very beautiful finish can be produced. These solutions can be sprayed, brushed or dipped on the article to be coated and collectively are known as lacquers. Everyone is familiar with the extensive use made of them today. Great economies have been made in some industries through the use of these types of covering materials (notably the automobile industry).

When solutions similar to lacquers are coated on canvas or other fabrics a textile product can be produced that is used in place of leather (artificial leather); in fact, the technique of this manufacture has advanced to the stage that is very hard sometimes to distinguish between real and artificial leather.

Cotton seed at one time was an item of waste and it was an economic item and was allowed to rot until someone discovered that it made a good fertilizer. Finally, someone found that an oil could be obtained by expression of the seed. After the linters are removed, the seeds are crushed and cooked, placed into machines and made into cakes which resemble large waffles and then placed in hydraulic presses where the oil is expressed from the crushed seed.

We have a large number of products which are obtained from the cottonseed oil. One of the more familiar products is "Crisco." It is made in a large cylindrical vessel containing a shaft to which is fastened a screen which continually revolves and into this vessel, the oil is pumped and hydrogen is introduced therein under pressure. After this batter turns for a time a certain amount of hydrogen is taken up and the oil is converted into a solid which is very clear and bland and has a wide range of uses.

Some of the cottonseed oil is used as salad oils, etc., and some of the hydrogenated oils are made into food products, and one of these substances is "oleomargarine." This is a very carefully regulated industry, because the slightest contamination in the product would result in no sale. It is made from milk, hydrogenated cottonseed oil and other fats. The milk is pasteurized and inoculated with certain kinds of bacteria and then quickly chilled and put into large vats and churned with the oils and fats.

After this is churned for a certain time it is churned into a vat of cold water and carried towards one end of the machine on a traveling belt. This takes out certain substances made in the churning process. It is then put on circular tables, similar to those used in the manufac-

turing of butter, and then taken to another room, where it is placed in a hopper and then cut in another machine into the familiar one-pound bricks and then wrapped and sent to the packing room.

An important by-product of the cottonseed is cottonseed meal, obtained after expressing the oil from the cottonseed oil-cake. The meal has been used for some years as a fertilizer and also as feed for cattle. Because of its protein content it has also been proposed to use the meal-cake as a synthetic beefsteak. The protein content of the cottonseed meal is 12.80 gm. per 100 calories compared with 9.05 gm. of protein per 100 calories for whole eggs. As a meat substitute it could be retailed for five cents per pound, with a yearly supply of millions of pounds.

From the hulls of the seed also known as cottonseed "bran" a sweet sugar by the name of xylose can be obtained by suitable chemical manipulation and extraction. This sugar contains five carbon atoms in one molecule, whereas ordinary cane sugar contains twelve carbon atoms in one molecule. This sugar can be produced and sold for five cents per pound, with a yearly production of one to one and a half million pounds.

Apropos of the miniature golf craze, thousands of the putting greens of these courses are covered with a matted or felted mixture of dyed cottonseed hulls.

The kingdom of KING COTTON is indeed a vast dominion.

ABSTRACTS* OF THESES PRESENTED TO THE FACULTY OF THE PHILADELPHIA COLLEGE OF PHARMACY AND SCIENCE

New Assay Method and Identification Tests for Mild and Strong Silver Proteinate

IDENTIFICATION of both mild and strong silver proteinates is accomplished by the use of two well-known reagents, namely, Tanret's Solution and Nessler's Solution.

Tanret's solution produces a flocculent yellow precipitate when added to an equal quantity of 1 per cent. solution of strong silver proteinate. With the mild silver proteinate a flocculent grayish black precipitate is given.

Nessler's reagent is even more distinctive when used under the same conditions. A clear golden brown solution is produced with the strong silver proteinate and bluish black solution with the mild proteinate.

Both of these solutions worked satisfactorily as identifying agents with Protargentum, Protargol, Silver Protein, Merck and P. W. R., Argyrol, Solargentum and Argo Nuclein (S. K. F. Co.).

A new assay method, much more rapid than the present U. S. P. X, is as follows:

Weigh 0.5 gm. of the silver compound, dissolve in 20 cc. water, then add 20 cc. nitric acid (conc.) and boil for ten minutes. Cool, dilute to about 150 cc., and titrate with potassium thiocyanate N/10 using ferric alum as an indicator. This method produced results identical with those obtained by the U. S. P. X method.—(*Abstract of Thesis presented by I. H. Inabinette.*)

Determination of Sulphur Dioxide in Foods Containing Sulphur-bearing Volatile Oils

An attempt was made to develop a method which would enable the determination of sulphur dioxide in such products, as prepared horse radish and prepared mustard.

As an initial step, a saturated aqueous solution of volatile oil of mustard was used to determine the extent to which this would be con-

*Abstracts prepared by Joseph W. E. Harrisson, Chemical Laboratories of the Philadelphia College of Pharmacy and Science.

verted to sulphate by oxidizing agents. One hundred cc. of this volatile oil solution was oxidized with bromine, iodine, hydrogen peroxide (hot) and hydrogen peroxide (cold). The sulphates formed were then precipitated with $BaCl_2$ in the cold. Barium sulphate obtained from above methods was as follows:

Bromine oxidation	236.	mgm. $BaSO_4$
Iodine oxidation	19.4	" "
Hydrogen Peroxide oxidation (hot)...	18.8	" "
Hydrogen Peroxide oxidation (cold)..	1.2	" "

All of these methods were then used in examining a solution of sulphites in saturated solution of volatile oil of mustard. The cold hydrogen peroxide method in all tests gave results within a reasonable tolerance.

This method was then selected for determining the sulphur dioxide content of prepared horse-radish and prepared mustard to which had been added 150 p.p.m. of sulphur dioxide.

The following method was used: To 54 gm. of the material in a 500 cc. flask add 200 cc. water, 5 cc. phosphoric acid 10 per cent. and about 0.5 gm. of tannin. Distillation is then carried out slowly in a current of carbon dioxide until 100 cc. was received in 20 cc. of solution of hydrogen peroxide. Sulphates were then determined in the cold, gravimetrically with $BaCl_2$. A résumé of the results is as follows:

Prepared Horse-Radish

No added SO_2	*150 p.p.m. added SO_2*
1. 21 p.p.m. SO_2	156 p.p.m. SO_2
2. 23 " "	152 " "
3. 24 " "	150 " "

Prepared Mustard

No added SO_2	*150 p.p.m. added SO_2*
1. 14 p.p.m. SO_2	177 p.p.m. SO_2
2. 18 " "	174 " "
3. 16 " "	172 " "
4. 18 " "	172 " "
5. 20 " "	178 " "
6. 16 " "	176 " "

It would seem that any result in excess of 25 p.p.m. of apparent SO_2 in prepared horse-radish or prepared mustard would indicate the presence of added SO_2.—(*Abstract of thesis presented by Frank A. DiBello, Ph.G.*)

Assay of Solution of Magesium Citrate

The present method of the U. S. P. X for magnesium requires evaporation and ignition, a time-consuming operation and one in which error may arise. Direct precipitation as suggested by Mayer [Jour. A. Ph. A. IX, 253] was tried. This method is essentially as follows: To 10 cc. of the solution add 20 cc. hydrochloric acid 10 per cent., then add an excess (20 cc.) of sodium phosphate T. S. Gradually add ammonia water until faintly alkaline and then add excess ammonia water with constant stirring. After three hours filter through weighed Gooch crucible, washing well with well-diluted ammonia water. Ignite and weigh. Comparative analyses were run, using the present U. S. P. X method. A résumé of the results obtained is as follows, expressed in grams magnesium oxide per 10 cc.:

	Direct Precipitation *MgO*	*U. S. P. X Method* *MgO*
Lot A	0.177	0.178
	0.176	0.177
	0.177	0.177
	0.177	0.178
Lot B	0.182	0.182
	0.181	0.181
	0.181	0.181

As the variation is in no case in excess of 0.001 gm. the method is to be recommended due to its simplicity and time saving.

In the determination of total citric acid the U. S. P. X directs the direct titration of the total alkali resulting from the determination of free citric acid and subsequent ashing, with N/2 acid using methyl orange as an indicator. As the magnesium oxide formed in the ignition is not soluble in water and only reacts slowly with the standard acid, it is difficult to obtain the proper end point. It is also necessary to destroy all the free carbon by repeated moistening and ignition. This is difficult and often involves loss of alkali.

A simple modification of the present method insures a smooth working, accurate assay.

The material after determination of the free acid is evaporated and ashed as usual. The ash is then transferred to a porcelain dish with hot water and 50 cc. of N/2 sulphuric acid added. It is then boiled, cooled, and the excess of N/2 acid determined by titration with N/2 sodium hydroxide using methyl orange as the indicator.

U. S. P. X Method	*Residual Titration Method*
Cc. N/2 acid for total alkali from 10 cc. of solution.	
30.0 cc.	30.1 cc.
29.7	30.0
29.9	30.2
29.5	30.2
30.1	30.1

Slightly higher but more consistent results are obtained by this method. —(*Abstract of thesis presented by Herman W. Haussmann.*)

Assay Methods for Ointments Containing Mercury or Its Salts

Mercurial Ointments—The present method as outlined in the U. S. P. X gives satisfactory and consistent results.

Calomel Ointment—The following method is suggested: Weigh about 1 gm. of the ointment directly on a dense filter paper. Fold and pass carbon tetrachloride through until fat free. Place paper in glass-stoppered flask, add 10 cc. carbon tetrachloride, 30 cc. N/10 iodine, 3 gm. KI and 10 cc. water. Shake well, allow to stand twelve hours, and determine excess N/10 iodine with N/10 $Na_2S_2O_3$. Twelve determinations gave results varying from 30.09 per cent. to 30.5 per cent. calomel.

Yellow Oxide of Mercury Ointment—A number of methods were used. (1) Boiling with HNO_3, adding water and titrating with KCNS N/10. (2) Same as No. 1, except filtering off fat before titration. (3) Treatment as in 2 and precipitating mercury and sulphide. (4) Destruction of fat with concentrated sulphuric acid and potassium permanganate and determination of mercury as sulphide.

None of these methods gave results which were consistent or in agreement with the known composition of the specially prepared yellow

mercuric oxide ointment.—(*Abstract of thesis presented by R. O. Metzler.*)

Determination of Boric Acid in Ointment of Boric Acid U. S. P. X

Numerous methods were compared, as to the results obtained and time consumed. All methods gave results within a range of 9.4 per cent. to 10.03 per cent. of boric acid in a specially prepared boric acid ointment. The method finally adopted as being the one most satisfactory gave results from 9.80 per cent. to 10.00 per cent. of boric acid content in the specially prepared boric acid ointment. The method is as follows:

Place 25 cc. chloroform, 10 cc. glycerin and 1 cc. of phenolphthalein T. S. in a well-stoppered container. Shake, add N/10 alkali to faint pink color. Then introduce about 1 gm. of boric acid ointment weighed on wax paper, add 25 cc. of N/10 NaOH. Shake well and determine excess of N/10 NaOH by titration with N/10 H_2SO_4. —(*Abstract of thesis presented by Theodore Budin.*)

Investigation of Calcium Hypochlorite (65 Per Cent. Available Chlorine)

Quantitative analysis of a commercial supply of a product marketed under the trade title H. T. H. by the Mathiesen Alkali Works, Inc., gave the following results:

Insoluble in water	8.40 per cent.
Silica (SiO_2)	0.28 per cent.
Iron Oxide (Fe_2O_3)	0.38 per cent.
Aluminum Oxide (Al_2O_3)	1.76 per cent.
Calcium Oxide (CaO)	32.17 per cent.
Available chlorine	62.70 per cent.

—(*Abstract of thesis presented by Bernard Melkon.*)

Assay of Chloroform Liniment

A method suggested by Willgerodt (*American Jour. Pharm.* 97, 9, 1925), who saponifies the chloroform under pressure with alcoholic potassium hydroxide and subsequently determines the chlorides formed, was compared with a direct standard alkali saponification and titration of residual alkali.

A standard liniment was made containing 45.17 per cent. of chloroform.

Willgerodt Method	*Alkali Method*
Error	*Error*
— 1.78	— 31.68
— 1.78	— 31.68
— 0.20	— 30.69
— 0.40	— 31.35
— 0.20	— 30.37
— 0.40	
— 0.40	
— 0.20	

It will be noted that direct alkali saponification does not give correct results.—(*Abstract of thesis presented by John C. Brantley, Jr.*)

MEDICAL AND PHARMACEUTICAL NOTES

Artificial Life—Artificial life, made out of non-living stuff in the laboratory, is a dream as old as the alchemists' ambition to make gold out of lead. If Dr. George W. Crile, of Cleveland, has really accomplished what is claimed for him in current newspaper dispatches, he has established his place in a seat of honor sought for since the middle ages.

But two things about the situation leave scientists, for the most part, still in the State of Missouri. First is the wall of secrecy surrounding the present experiments, which one newspaper man has partially penetrated. This they admit is legitimate, but, it is pointed out, it has the practical result of giving nobody anything to base a discussion on.

The second cause for skepticism is the large number of apparent successes in this same experiment that have in the end come to nothing. There have been literally dozens of flasks and test-tubes displayed at different times, with what were apparently living plants and animals in them. But these have all been set back on the shelves, without issue. If Dr. Crile has succeeded at last in boosting the non-living across the line into the land of the living, he is to be hailed as a conqueror. But they will wait until the Cleveland meeting of the American Association for the Advancement of Science to see for themselves.

One of the most promising looking and at the time the most sensational of these efforts to make life in a test-tube was that of H. C. Bastian, who in 1911 put various non-living constituents in glass tubes, sealed them up, heated them to a point where no living thing could survive, and then let them stand in diffuse sunlight for several months. Gradually little particles of jelly-like stuff appeared in the tubes, some of them looking like fungi, some like yeasts, some like minute bacteria. These absorbed certain dyes in the same way that their "natural" models absorb them, and also reproduced themselves when fed on suitable substances. But they were only a nine days' wonder to the public; only scientists remember them now.

More recently a pair of noted physiologists, Dr. D. T. MacDougal and Dr. Vladimir Moravek, made an artificial cell, not claiming that it was alive. They merely impregnated a paper thimble with a vegetable

jelly, coated it with another vegetable substance found on the outside of cells, and lined it with a jelly containing some of the constituents of living protoplasm.

When immersed in water or solutions of various chemical salts, this artificial cell, non-living though it avowedly was, displayed many of the characteristics of life. It enabled its inventors to get a new insight into some of the mechanics of real cells, which was what they were after. As such it was a good laboratory tool. But it did not contain the "secret of life."

About a quarter of a century ago there was a great deal of excitement over the supposed "creation of life" by the noted physiologist, Dr. Jacques Loeb. It annoyed him very much, for he had not created life. He had done a notable thing, however; he had caused unfertilized eggs to begin developing without adding any sperm or male element, simply by treating them with chemicals, pricking them with fine needles, and otherwise stimulating them.

Since that time many other scientists have repeated this work with variations. One has produced young sea-worms with no other father than an electric current. Another brought little frogs into the world that were half-orphans from birth, unless one is willing to call a steel needle their sire. But all these experiments start with living eggs. They in no way create life. They merely stimulate life that is already existing but dormant in the unfertilized egg.

The problem of the origin of life on earth has been so baffling that some scientists and philosophers have "passed the buck" by postulating the drifting of a few living germs through space from another planet. Prof. Svante Arrhenius, famous chemist, subscribed to this view before his death. But the difficulties of such a transfer are almost insuperable. The intense cold of outer space, the tendency of some of the necessary elements, notably oxygen, to diffuse out of the drifting germs, and the unimaginably long years of drifting that would be needed, if the matter were left entirely to chance, together with other obstacles, pile up a barrier too high for the imagination of most scientists to surmount. Besides, even if life did come here from somewhere else, the question would still stand: how did it get where it came from in the first place?

Most scientists prefer to believe that life originated here on our own planet, although with Darwin they do not profess to have any positive knowledge of how it came about.

If the answer is in Dr. Crile's test-tubes they are more than willing to be shown.

But they must be shown.

Light Accelerates Spoiling of Fats—A careful study of the chemistry of the spoilage of fats by C. H. Lea, of the Low Temperature Station, Cambridge, has revealed the fact that light plays an important part in its development.

Mr. Lea found that under ordinary conditions fresh beef kidney fat keeps well for a certain initial period, and then quickly becomes rancid. When the fat is kept in darkness, there is a longer initial safe period before it begins to spoil.

Bright light has the opposite effect. If the fat is exposed to direct sunlight on a hot day, rancidity sets in very rapidly, and the initial safe period may be almost completely eliminated. If the fat is placed in sunlight long enough for spoilage to start, even subsequent removal to a dark place will not improve matters very much.

Iodine in California—Iodine, expensive and pungent-smelling chemical, has been discovered in paying quantities in southern California. This comparatively rare chemical element has long been controlled by a South American monopoly which regularly maintains a "pegged" world price on the commodity at a high level. Industries concerned with an iodine supply during possible future war blockade are much interested in the local prospects.

Some time ago Los Angeles petroleum chemists, analyzing brackish waters from oil wells near Long Beach, Calif., discovered iodides in commercial quantity. So great is the mass of worthless salts associated with the iodine, however, that difficulty has been experienced in extraction of the desired product. At least one company, however, has attained some success with the problem, and California iodine is appearing on the market.

One of the favored methods of manufacture involves the treatment of the brine with nitrous acid, which drives the iodine out of its salty compounds and permits it to be absorbed in activated charcoal much as war gases were caught in gas masks. Distillation of the loaded charcoal yields the precious product, which commands about four dollars per pound.—(*Science Service.*)

Colloidal Iodine (1 in 1000 Solution)—By F. C. Bennett, B. Sc. (College of Pharmacy, Brisbane).

Alternative Formulae. (1).

Sodium Iodide (5 per cent. solution)	min.	90
Sodium Nitrite (5 per cent. solution)	min.	42
Acid Hydrochlor. Dil., B. P.	min.	21
Gum Acacia	gr.	120
Gelatine	gr.	90
Distilled Water to produce	fluid oz.	8

Dissolve the gelatine with the aid of heat in 3 fluid oz. of the distilled water. To this solution, on cooling, add the Sodium Iodide solution and the Dilute Hydrochloric Acid. Strain carefully (it is preferable to filter through a suction filter) and make up to 4 fluid oz. Cool thoroughly and add to the Sodium Nitrite dissolved with the Acacia in the remainder of the water. Leave stand for half an hour. Stir briskly to allow nitric oxide fumes to be evolved.

2.

Sodium Iodide, 5 per cent. solution	min.	76
Sodium Iodate, 5 per cent. solution	min.	20
Acid Hydrochlor. Dil., B. P.	min.	10½
Gum Acacia	gr.	120
Gelatine	gr.	90
Distilled Water to produce	fluid oz.	8

Dissolve the gelatine with the aid of heat in 3 fluid oz. of the distilled water. To this solution, when cold, add the Sodium Iodide solution and the Dilute Hydrochloric Acid. Clarify and make up to 4 fluid oz. Cool and add to the Sodium Iodate, dissolved with the Gum Acacia in the remainder of the water.

Notes.—(1) In formula No. 2 the Sodium Iodide can be replaced by 84 minims of a 5 per cent. solution of Potassium Iodide; the Sodium Iodate by 22 minims of a 5 per cent. solution of Potassium Iodate.

(2) The solutions, after 24 hours' storage at a low temperature and in the dark, contain 18 per cent. of the Iodine in a combined form, and the remainder partially dissolved and partially suspended in a colloidal condition. The solutions show brownian movement, and movement of Iodine in an electric field. The colour varies slightly

with slight differences of technique in preparing, being normally a clear, reddish-brown by transmitted light and a dull brownish red by reflected light; 82 per cent. of the contained Iodine can be shaken out with carbon bisulphide or estimated by titration with thiosulphate, or distilled. The whole of the iodide can be recovered and estimated by the usual procedure for the estimation of Iodine in organic combination.

(3) The solutions deteriorate quickly on storage, the Iodine being lost: (a) by combination; (b) volatilisation; (c) by reduction. If kept at 0 deg. C. the preparations retain half their strength of titratable Iodine for seven days.

(4) Several commercial samples of Colloidal Iodine contain no titratable or extractable Iodine, and exhibit no brownian movement or movement of colloidal particles in an electric field.—(*Austral. J. Ph.*, Dec. 1930, p. 1087.)

Effective Poison Found for Larvæ of Housefly—Economic entomologists believe in the old advice, "In time of peace, prepare for war." At the meeting of their national society, Dr. S. Marcovitch and M. V. Anthony of the Tennessee Agricultural Experiment Station, described a better poison to use against next summer's flies.

Houseflies, as is well known, breed in heaps of stable refuse. At present it is standard practice to sprinkle these with strong borax solution, because borax is known to be poisonous to their maggots or larvæ. But the two Tennessee entomologists have discovered that another low-priced chemical, sodium fluosilicate, is much more poisonous to the larvæ than borax. They recommend its use daily, and point out the further advantage that in the concentrations in which it is effective against fly larvæ it will not be harmful to plants. whereas very small amounts of borax are often damaging to crops. —(*Science Service.*)

Liver Extract Makes Plants Green—Liver extract, successfully used to check the course of pernicious anemia in human

beings, has been used to check the analogous yellowing of plants placed in the dark, by Prof. Oran Raber of Immaculata College, Pa. Professor Raber reported this research before the American Society of Plant Physiologists.

The activity of liver extract in checking this yellowing, or etiolation, of darkened plants, raises again the question of possible physiological relationship between chlorophyl, the substance that makes leaves green, and hemoglobin, the stuff that makes blood red. Liver extract keeps red blood in the veins of the anemic, it now appears to keep green chlorophyl in the leaves of plants.—(*Science Service.*)

CHEMICAL SOLUTION IN ALCOHOL IS ACID STRONG AS SULFURIC—A solution in wood alcohol of the chemical boron fluoride is as strong an acid as sulfuric. This fact was reported recently to the chemical section of the American Association for the Advancement of Science by Professor J. A. Nieuwland, of the University of Notre Dame. He concludes that the solution forms a separate compound.—(*Science Service.*)

CREMOR POTASSÆ SULPHURATÆ COMPOSITUS—COMPOUND SULPHURATED POTASH CREAM; MARCUSSEN AND EHLERS' CREAM—

Sublimed sulphur	320 gr.
Potassium hydroxide	160 gr.
Soft paraffin, yellow	400 gr.
Wool fat	400 gr.
Zinc sulphate	50 gr.
Sodium hydroxide	15 gr.
Distilled water	a sufficient quantity
Oil of bitter almonds	10 minims
Liquid paraffin, by weight ....to	4 oz.

Add to the potassium hydroxide its own weight of distilled water; while the solution is still warm add half the sublimed sulphur and heat gently on a water bath until the sulphur dissolves. Mix the solution with the soft paraffin and wool fat previously melted

together. Triturate this with the product obtained by mixing the zinc sulphate, dissolved in half its own weight of warm water, with the sodium hydroxide dissolved in five times its weight of water, and with the rest of the sulphur. Add the liquid paraffin and the oil. —(*Chem. & Drug.*, 1930, p. 791.)

Ethylene Oxide a New Weed Killer—A poison for undesired bushes such as poison ivy and European barberry, quick and sure in its action yet clearing out of the soil after its work is through, was described before the meeting of the American Society of Plant Physiologists by Professor R. B. Harvey of the University of Minnesota.

This new agent in man's chemical warfare against tough weeds is ethylene oxide, chemically related to the ethylene chloride which has been found very effective in hastening the ripening of fruits and vegetables. Professor Harvey discovered the value of ethylene oxide during the course of experiments with various ethylene compounds. He found that the oxide killed the fruits and vegetables instead of speeding up their ripening processes.

He tried the compound on some large barberry bushes, which are being harried out of existence in the great grain areas because they harbor the black stem rust of wheat. What he calls "depth charges" of ethylene oxide dissolved in water were sunk into holes pierced in the soil at the roots. A few days later the bushes were revisited, and in every case they were found to be in the last stages of the death struggle. About one and one-half ounces of ethylene oxide, diluted to a ten per cent. solution in water, usually sufficed for a large bush.

At present barberry bushes are fought either by digging them up, which leaves stray roots free to sprout again, or by dumping quantities of common salt into holes at their roots, which is rather hard on the soil. Other chemicals which are effective against them cannot be used because they are poisonous to cattle. "Depth charges" of ethylene oxide, Professor Harvey concludes, seem to offer the best means so far discovered for killing these and similar noxious plants.—(*Science Service.*)

Elixir Ephedrinæ—The following formula for elixir of ephedrine, elaborated by Herbert Skinner, Ph. C., is in use in the Royal Northern Hospital:

Ephedrin. hydrochlor.	gr. viij.
Menthol	gr. j.
Alcohol (90 per cent.)	ʒij.
Glycerin.	ʒiij.
Syr. aurant.	℥ij.
Aq. destillat. ....ad	℥iv.

If desired quite clear it may be clarified with calcium phosphate. —(*Chem. & Drug,* 1930, p. 790.)

Synthetic Liver Substance—Good news for the pernicious anemia sufferer may result from the recently announced investigations of Drs. R. West and H. D. Dakin and Marion Howe of Columbia University College of Physicians and Surgeons and Presbyterian Hospital in New York.

Doomed to eat half a pound of liver daily in order to remain alive and healthy, the anemia sufferers have found themselves longing for the predicted day when all our nourishment would be served in pills and capsules.

It was Drs. George R. Minot, W. P. Murphy and colleagues at Harvard Medical School, who made the life-saving discovery that eating liver was efficacious in the treatment of pernicious anemia. Almost immediately, wails were heard from patients who found liver-eating a trial. Some of them were silenced by a potent liver extract developed by Dr. E. J. Cohn, also of Harvard Medical School. The extract, however, is costly, and most of the sufferers must keep on with their liver diet.

Medical scientists, interested in the purely scientific as well as the practical problem, wanted to know exactly what it was in liver that was so effective in treating pernicious anemia.

Part of the answer has now been given by the Columbia investigators. From liver they isolated a crystalline salt which is active in pernicious anemia. Analyzing this salt, they found two chemicals betahydroxyglutamic acid and hydroxyproline, which are probably fragments of the active material. How these two are combined in the liver, and whether any other substances are combined with them has not yet been determined.

The practical application of this work is still in the future, but it seems possible that the synthesis of the active principle of liver may eventually be effected. When that has been accomplished, large-scale manufacture of a relatively cheap product may be expected.

ADDENDUM

"THE TINCTURES OF CINCHONA" (first paper)—A Preliminary Report, by Aaron Lichton, Ph. G. This Journal, Oct., 1930, p. 586.

Menstruum 6: The U. S. P. X menstruum without glycerin to which is added 1.5 p. c. absolute hydrochloric acid based on the quantity of the bark and used in macerating. Subsequently percolation is performed with two volumes of alcohol and one of water, placing in the receiving vessel an amount of glycerin equivalent to 7.5 p. c. of the expected percolate and then allowing percolation to proceed to the desired volume.

Menstruum 7: Four volumes of alcohol and one of water with 1.5 p. c. absolute hydrochloric acid based on the quantity of the drug used as the maceration menstruum. Subsequently percolating with four volumes of alcohol and one of water.

Menstruum 8: Four volumes of alcohol and one of water with 1.5 p. c. absolute hydrochloric acid based on the quantity of bark used for the maceration menstruum. Subsequently percolation is performed with four volumes of alcohol and one of water, placing in the receiving vessel an amount of glycerin equivalent to 7.5 p. c. of the expected percolate and then allowing percolation to proceed to the desired volume.